VOLUME 22, NO. 2 MARCH/APRIL 2001 (PUB-439)

BUILDING ENERGY SIMULATION

User News

For Users of EnergyPlus, SPARK, DOE-2, BLAST, Genopt, Building Design Advisor, ENERGY-10 and their Derivatives

What's New ?

.....Release of EnergyPlus, Version 1.0

EnergyPlus 1.0 was released April 12. Get your free download today by visiting our website and clicking on "EnergyPlus 1.0" in the left menu:

http://SimulationResearch.lbl.gov

..........VisualSPARK 1.0 Release

Purchase VisualSPARK 1.0. Information on p. 4.

...New Korean DOE-2 Resource Center

Prof. Jung-Ho Huh, Ph.D., an expert DOE-2 user, has established a new resource center at the University of Seoul. Dr. Huh graduated from the University of Colorado at Boulder, where he majored in Building Energy Systems Engineering. Address and email details are on p. 23.

.........DOE-2 Documentation on a CD

The Energy Science and Technology Software Center has scanned most of the DOE-2.1E documentation onto one CD. Cost is only $100; see p. 11 for ordering info. We are currently working in-house to convert the *DOE-2.1E Basics Manual* into pdf files for the web. Watch the *User News* for announcement of its availability.

..............Beta Test WINDOW 5

The WINDOW program calculates total window thermal performance indices. WINDOW 5 (Beta 1.0) is available to download and test. See p. 10.

..........New Therm 2.1a Download

The newest version of THERM is a bug-fix release based primarily on feedback from program users. Go to p. 10 for details.

What's Inside ?

EnergyPlus Version 1.0

EnergyPlus Version 1.0 was officially released on April 12, 2001 at the National Building Museum in Washington, DC.

Department of Energy Releases New Software To Help Reduce Building Energy Use

EnergyPlus Simulation Program Helps Building Designers and Owners Save Money, Reduce Energy and Improve Indoor Air Quality

(WASHINGTON, D.C., April 12, 2001) Secretary of Energy Spencer Abraham today released a next generation building energy simulation computer program that allows architects, engineers, building owners and managers to minimize energy use and cost and optimize building performance by simulating building energy use. The EnergyPlus program is a significant step beyond earlier Department of Energy (DOE) software, which building owners and designers have used to save an estimated $20 billion.

"The Department of Energy's EnergyPlus computer simulation program will assist home builders and designers dramatically lower energy use in buildings," said Secretary Abraham. "We want to help design teams and homeowners achieve energy efficiency even with tight scheduling constraints and significant dollars at stake."

EnergyPlus dramatically improves the simulation of whole-building approaches in design, planning and construction and opens new doors for energy savings, cost savings and indoor environmental quality. It allows users to calculate the impacts of different heating, cooling and ventilating equipment and various types of lighting and windows to maximize building energy efficiency and occupant comfort.

The full text of the article may be found at http://www.energy.gov/HQPress/releases01/aprpr/pr01050.html

Here is a list of some of the features in EnergyPlus 1.0.

Highlights of Version 1.0:
- Extensive example HVAC input files
- Heat pump simulations, including ground source
- Weather processor

Highlights of Beta 5.0/5.1/5.2:
- Heat/Cool option on furnace
- DX System (Air Loop)
- High temperature radiant heating/cooling
- More operative controls for all radiant modeling (MAT, MRT, operative temperature)
- Gas absorption chiller/heater
- Desiccant dehumidifier
- Plenum (return and supply)
- Active and passive Trombe wall input templates
- Air- and Evaporatively-Cooled condenser
- Gas/electric coil options for unit heater and unit ventilator
- First-level energy meter reporting
- Low-temperature radiant heating/cooling
- Interior surface convection options, including air change rate dependence
- Thermal comfort options
- Evaporative cooler models
- Steam absorption chiller
- Air-flow sizing (based on zone requirements)
- Improved sky model for daylighting calculations

Highlights of Beta 5.0/5.1/5.2: (continued)
- Ability to read weather files with sub-hour intervals
- Enhanced calculation of return air heat gain from lights
- Flat-plate exhaust air heat recovery
- Translator from CAD IFC geometry to EnergyPlus geometry
- HVAC input templates
- Furnace

Highlights of Beta 4:
- Moisture adsorption/desorption in building envelope
- Thermal comfort modeling and reporting (KSU model and Pierce two-mode model)
- Further windows calculations, including extensions to the frame/divider calculation; window U-value and solar heat gain coefficient report
- Addition of a window multiplier
- DOE-2 to EnergyPlus Loads input translator (initial version)
- Shading of sky IR by obstructions
- Controls for natural ventilation through windows
- 3-D surface input
- COMIS integration (interzone air flow, natural ventilation)

Highlights of Beta 3:

- Fan coil, unit heater, unit ventilator, window AC simulations
- Window enhancements (frame and dividers, spectral input for glass)
- EPMacro—macro capability for input files (auxiliary program)

Highlights of Beta 2:

- WINDOW 5-based glazing calculations
- Movable window shades
- Thermal comfort modeling and reporting based on Fanger model
- Revised HVAC modeling, including branch-based input and flow resolver
- Exhaust fan

Highlights of Beta 2: (continued)

- Simple launch program for EnergyPlus
- Fan control, fan motor placement
- Simple input and output preprocessor
- Reference data sets for materials, constructions, windows, etc.

Highlights of Beta 1:

- Simultaneous simulation of zone loads and HVAC systems
- Daylighting
- Simple input and output processing
- Simple input editor capabilities
- BLAST translator (.bin files) to EnergyPlus input
- E/E+ format weather processing
- Basic HVAC simulation

In order to use EnergyPlus, you must execute a license agreement. A brief explanation of each license type is presented below. However, for an in-depth explanation of license types, please visit our web site at http://SimulationResearch.lbl.gov. Click on EnergyPlus in the left menu and follow the pointers.

Type of License Agreement	Description	Cost
End User License	Allows internal use of the EnergyPlus executable.	Free
Distribution License	Grants you the right to distribute the EnergyPlus executable or use it in a web-based application.	US$1000
Source Code Addendum to the Distribution License	Allows internal use of the EnergyPlus source code to develop derivative works. You may execute a Source Code Addendum at the same time as executing the Distribution License Agree-ment or at a later date; however, to obtain the Source Code Addendum you must also purchase a Distribution License Agreement.	US$1500
Collaborative Developer's License	Allows you to inspect the EnergyPlus source code in-house and to create derivative works from it for non-commer-cial purposes. This license requires that you provide, at no cost, to Lawrence Berkeley National Laboratory and the University of Illinois any improvements you make, and such improvements (other than user interfaces) will be considered for incorporation into a future version of EnergyPlus. If you want to distribute your derivative work, you must obtain a Distribution License Agreement.	US$100

EnergyPlus is being developed by University of Illinois, CERL, Oklahoma State University and Lawrence Berkeley National Laboratory, with the assistance of the Florida Solar Energy Center, GARD Analytics, Krarti Associates, Pennsylvania State University, and the University of Wisconsin.

VisualSPARK

Release of Version 1.0

Available from Lawrence Berkeley National Laboratory,
VisualSPARK 1.0 allows you to build customized models of complex physical processes by connecting calculation objects. It is aimed at the simulation of innovative and/or complex building systems that are beyond the scope of programs like DOE-2 and EnergyPlus.

The main elements of VisualSPARK are a **user interface**, a **network specification language**, a **solver** for solving simultaneous algebraic and differential equations, and a **results processor**. With the network specification language you create equation-based calculation objects, and link the objects into networks that represent a building's envelope or HVAC components or systems. The solver solves this network for user-specified input parameters. With the results processor you graphically display the results of the calculation. VisualSPARK runs under the Windows 95/98/NT/2000, SunOS, Solaris, Linux and HPUNIX operating systems.

VisualSPARK costs $250. To purchase the program, go to
http://SimulationResearch.lbl.gov > VisualSPARK > Purchase

If you would like to get an idea of what the program does before purchasing it, you can review the SPARK User's Manual, which can be downloaded from http://SimulationResearch.lbl.gov > SPARK

VisualSPARK was developed by the LBNL Simulation Research Group and Ayres Sowell Associates, with support from the U.S. Department of Energy, Drury Crawley, program manager

http://SimulationResearch.lbl.gov > SPARK

What's New in SPARK Model Development?

Fault Detection and Diagnosis

SPARK is being used to develop **models of HVAC equipment for** use in **fault detection and diagnosis.** The models will be used on-line in real buildings to determine whether the HVAC system is performing as expected. Measurements from sensors connected to the energy management and control system or to a dedicated monitoring system will be used as inputs to the models. The predictions of the models will then be compared to other measurements and significant differences taken as indications of faulty behavior. SPARK has a number of advantages as a development environment. The hierarchical, modular, structure of the models provides flexibility and facilitates model reuse. SPARK models are based on equations and graph theoretic methods are used to automatically find efficient solution procedures, allowing the developer to concentrate on modeling issues. SPARK generates an executable for a system model and this executable can then be called by the diagnostics software.

Current work is aimed at the development of **models of air handling unit components**, including mixing boxes, heating and cooling coils and fan systems. Of these, the most challenging is the cooling coil, particularly the modeling of partially wet operation. The detailed model of partially wet operation in the ASHRAE HVAC Secondary Toolkit splits the coil into a wet region and a dry region and uses an iterative procedure to find the position of the boundary between the two regions. This procedure was found to be numerically unstable, failing to converge under extreme conditions (for example, high humidity ratio). This and other problems with this two-zone modeling approach prompted the development of a new approach in which the coil is divided into a significant number of discrete, fixed sections in the direction of the airflow. The driving potentials for heat and mass transfer are taken to be constant in each section, allowing the heat and mass transfer processes to be modeled separately but solved simultaneously. Division into 20 sections has been found to yield reasonable results without convergence problems or excessive computational load. (continued)

The work described above is funded jointly by the California Energy Commission and the US Department of Energy. For more information, contact LBNL's Philip Haves (Phaves@lbl.gov)

What's New in SPARK Development? (continued)

Hydronic Rooftop Package Unit

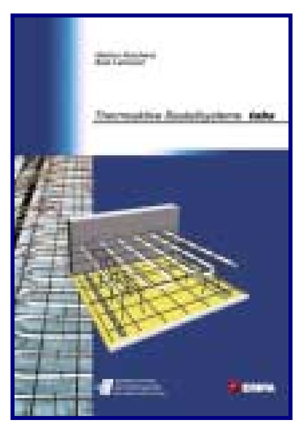
SPARK is being used to develop a performance model for a new type of **rooftop air conditioning unit** known as the **Hydronic Rooftop Package Unit (HyPak)**. This work is one part of a project whose aim is to develop a cost-effective, rooftop packaged HVAC unit that reduces HVAC electrical energy consumption and peak demand compared to current rooftop units by more than 65% in dry climates and 50% in humid climates. The major feature of the new unit is a new high performance counterflow evaporative water cooler (CEWC) that also functions as a ventilation air pre-cooler, an exhaust air heat recovery device and an evaporatively-cooled condenser to reduce compressor energy consumption. The sizing of the main components of HyPak will be optimized by combining the energy costs predicted by the SPARK model for different component sizes with the first cost predicted by a cost model.

The CEWC is a counterflow air-to-air heat exchanger in which ambient air is precooled on one side of the heat transfer surface by water flowing on the other side of the surface. The water is evaporatively cooled by a secondary air-stream flowing through the heat exchanger on the same side as the water but in the opposite direction. There is sensible heat transfer from the dry air to the surface and from the surface to the water and there is both sensible and latent transfer from the water to the secondary air. The performance of such a heat exchanger cannot be predicted analytically and so a model has been developed using SPARK in which the CEWC is divided into a significant number of discrete, fixed sections in the direction of the airflow. The driving potentials for heat and mass transfer are taken to be constant in each section, allowing the heat and mass transfer processes between three fluid streams to be modeled separately but solved simultaneously. The heat and mass transfer coefficients have been determined by comparing the performance of the CEWC predicted by the model with the performance measured in the laboratory.

The model of the CEWC has been linked to models of the other components, including a compressor, evaporator, condenser, cooling coil, three fans and two pumps, each of which has been implemented as a SPARK object. The resulting system model will be used to predict system performance and operating costs under different load and climate conditions in order to optimize component sizes and compare HyPak performance to conventional rooftop package units. SPARK, which is an object-oriented simulation environment, is an ideal tool perform such simulation. Models of the individual components can be developed and tested separately and then interconnected to specify the model of the entire system. The different operating modes to be employed in HyPak involve using different combinations of components, sometimes connected in different ways. Using SPARK, the same component and subsystem models can be used for the different configurations, saving the work of redevelopment.

The HyPak work is being performed at LBNL as part of a DOE NETL project led by the Davis Energy Group. For further details, contact Peng Xu (PXu@lbl.gov) or Philip Haves (PHaves@lbl.gov).

Thermoaktive Bauteilsysteme (Thermoactive Building Elements) (in German)
by Markus Koschenz and Beat Lehmann



The book shows the theoretical relations between the systems involved and gives rules for the layout of thermoactive building elements. Topics include:

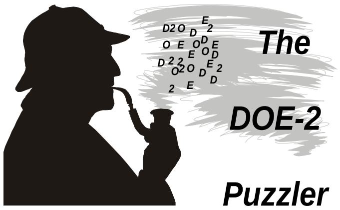
- building requirements, comfort, physics
- modeling and design of the piping system
- cooling load and design of cooling system
- heating load and its simulation

To order, contact the Building Simulation Group:

Energy Systems/Building Equipment
EMPA
Überlandstrasse 129
CH - 8600 Dübendorf
SWITZTERLAND

Fax: +41 (0)1 823 40 09

http://www.empa.ch/erg



Question: I have been trying to find out the formulas used to calculate the losses associated with CCIRC-PUMP-TYPE when set to VARIABLE-SPEED. According to the manual, the energy reduction associated with switch from a constant volume flow system to a variable volume flow system is determined on the basis of the actual loads being served by the pumps. However, I haven't been able to derive the numbers that the hourly reports are giving me. I was wondering if there is some other place that explains these commands in more detail. If not, is there I way I can find out how the calculations are being done? Also, can I change any parameters to get it to vary the pump power instead of varying the loads served by the pumps.

Answer: I'm not sure which variables you are looking at in the hourly reports. Obvious ones seem to be CPELEC and CHGAIN, Variable-TYPE = PLANT, in PLANT. The code that does the calculation and a table defining the variables follow.

```
GPM = LOAD / (CDESDT * 8.34 * 60.)
C                               ELECTRICAL CONSUMPTION MUST
C                               EXCEED MINIMUM OF DESIGN
      CPELEC = AMAX1((CPDSEL * CMNPLR),
     1              (.643 * CPHEAD * GPM / (CEFFM * CEFFI)))
C                               HEAT GAIN
      CHGAIN = LOAD * CLOSS
C                               ADD IMPELLER ENERGY
      CHGAIN = CHGAIN + CPELEC * CEFFM
```

Variable Name	Description (All keywords are in the PLANT-PARAMETERS command)
GPM	chilled water flow rate in gallons per minute.
LOAD	plant cooling load in in Btu/hr for this hour.
CDESDT	keyword CCIRC-DESIGN-T-DROP, the design temperature drop in the chilled water loop; default is 10°F.
8.34	density of water in lbs/gal.
60.	minutes per hour.
CPELEC	Electric input to pump in Btu/hr. Note that CPELEC comes out in the hourly reports in kW.
CPDSEL	The design electric consumption. Calculated the same way as CPELEC except the load used is the peak cooling load.
CMNPLR	Keyword CCIRC-MIN-PLR, the minimum part load ratio at which the pump can run.
.643	Conversion factor from Head (in feet of water) times flow rate (in gallons per minute) to energy in Btu/hr. The units are (Btu/hr)/(ft)(gal/min).
CPHEAD	Keyword CCIRC-HEAD, the head pressure in the chilled water loop in feet of water.
CEFFM	Keyword CCIRC-MOTOR-EFF, the efficiency of the pump motor.
CEFFI	Keyword CCIRC-IMPELLER-EFF, the pump impeller efficiency.
CHGAIN	CHGAIN is not just the heat gain from the pump; it has the conduction heat gain from the environment added in, and the default for CLOSS is 0.01. This might mess up your calculations. Try setting CCIRC-LOSS = 0.0.
CLOSS	Keyword CCIRC-LOSS, the conduction heat gain of the pipes in the chilled water loop as a fraction of the cooling load. Note that the default is 0.01.

There is no way for the user to size the pumps by hand. The only options are to size on the peak load (CCIRC-SIZE-OPT = SYSTEM-PEAK) or on the installed chiller capacity (CCIRC-SIZE-OPT = INST-PLANT-EQUIP). The pump electrical consumption is either constant (CCIRC-PUMP-TYPE = FIXED-SPEED) or varies with the chilled water load (CCIRC-PUMP-TYPE = VARIABLE-SPEED).

San Diego Gas & Electric

Whole Building Performance Training

REGISTER AT HTTP://WWW2.SDGE.COM/SEMINAR

May 10 (Thursday) 8:30 am to 4:00 pm	**H-P Design Strategies: Lighting, Windows and Building Envelopes with EnergyPro 3.0**
May 15 (Tuesday) 9:00 am to 3:00 pm	**Energy-Efficiency Opportunities in Chilled Water Plant Design**
June 8 (Friday) 9:00 am to 11:30 am	**High Performance Windows**
August 03 (Friday) 9:00 am to 3:00 pm	**Design Underfloor Air Distribution Systems for Maximum Efficiency**
September 13 (Thursday) 8:30 am to 4:00 pm	**H-P Design Strategies: Lighting, Windows and Building Envelopes with EnergyPro 3.0**
September 14 (Friday) 8:30 am to 11:30 am	**Mechanical System Design and Modeling Using EnergyPro 3.0**
September 14 (Friday) 1:00 pm to 4:30 pm	**Advanced Building Modeling with EnergyPro 3.0**

❾

PG&E Spring 2001 Programs

Pacific Gas and Electric Company
WE DELIVER ENERGY.

To register call 415.973.7268 or go to **www.pge.com/pec**

	HVAC
May 17 (Thursday) 9:00 am to 4:30 pm	**HVAC Load Calculation Methods and Applications** Discussion of common load calculation methods used to size equipment and distribution systems.
May 23 (Wednesday) 9:00 am to 4:30 pm	**Evaporative Cooling** Design of direct and indirect evaporative cooling systems, evaporative pre-cooling for air-cooled condenser, indoor air quality issues, energy savings calculations.
	ARCHITECTURE
May 22 (Tuesday) 9:00 am to 1:00 pm	**Controlling Moisture in Residential and Small Commercial Buildings** Common design and installation defects that can create moisture problems; recommendations for good practices, mitigation of mold/mildew, building mate-rials that improve building durability, energy efficiency and indoor air quality.
June 20 (Wednesday) 6:00 pm to 9:00 pm -and- **June 21** (Thursday) 6:00 pm to 9:00 pm	**Site Analysis for Architects** How to assess climate data, apply site analysis techniques, and use measurement tools to design energy-efficient buildings.

Recent Reports

Report LBNL-47275 is available as a .pdf file on our website at http://SimulationResearch.lbl.gov/dirpubs/47275.pdf

LBNL-47275

An Empirical Correlation for the Outside Convective Air Film Coefficient for Horizontal Roofs

by
R. D. Clear, L. Gartland and F. C. Winkelmann
Environmental Energy Technologies Division
Lawrence Berkeley National Laboratory
Berkeley CA 94720-0001

Abstract

From measurements of surface heat transfer on the roofs of two commercial buildings in Northern California we have developed a correlation that expresses the outside convective air film coefficient for flat, horizontal roofs as a function of surface-to-air temperature difference, wind speed, wind direction, roof size, and surface roughness. When used in hourly building energy analysis programs, this correlation is expected to give more accurate calculation of roof loads, which are sensitive to outside surface convection. In our analysis about 90% of the variance of the data was explained by a model that combined standard flat-plate equations for natural and forced convection and that took surface roughness into account. We give expressions for the convective air film coefficient (1) at an arbitrary point on a convex-shaped roof, for a given wind direction; (2) averaged over surface area for a given wind direction for a rectangular roof; and (3) averaged over surface area and wind direction for a rectangular roof.

Question:

We are trying to **model a diesel generator for load shedding during on-peak periods.** The outputs indicate that the generator uses more electricity than our baseline run! This may be partially due to uncontrollable heat rejection energy of the generator or improper inputs. On report ES-D, Total Elect Charge with the generator is $588,983 vs $583,534 on the baseline run; the total energy cost is $662,708 vs $629,701 for baseline (only $27,590 for oil). On report ES-E the metered energy during June-Oct is higher than the baseline run and the metered demand stays the same. Under the BEPU report, the heat rejection at 232,255 kwh is higher than baseline at 132,082 kwh. Generally, I can't see why operating a diesel generator during on-peak periods for load shedding consumes more electricity. Please advise if DOE-2 is capable of simulating savings for this generator.

Please email your "DOE-2 Puzzler" questions to
klellington@lbl.gov

Answer:

If you look at plant report PS-D under ELECTRICAL LOADS you can see that the diesel generator is operating and meeting 5.8% of the electrical load.

The problem seems to be in Economics, which doesn't know what to do with the electricity produced by the generator (basically it is ignored and all the electrical consumption is charged to the utility).

To fix this add the following Utility-Rate to your Economics input:

```
GEN-ELEC = UTILITY-RATE
RESOURCE = ELEC-NET-SALE  ..
```

This tells the Economics program to use the generator electric output to meet the electric load. If you then look at ES-D you will see the electricity charged to utility rate TOU-BLK reduced accordingly and the dollars also reduced.

California Energy Commission

The new 2001 AB 970 Residential and Nonresidential Energy Efficiency Standards take effect on June 1, 2001. The Commission anticipates that new Residential and Nonresidential Manuals will be available in August 2001. Until the new manuals are available, please refer to the Manual Supplements (available at http://www.energy.ca.gov/ab970_standards/documents/index.html), Publication Nos. 400-01-002S and 400-01-005S.

In other news, *Blueprint*, CEC's newsletter, has gathered together residential and nonresidential questions and answers from all past issues (Nos. 1 to No. 62). They may be found at: http://38.144.192.166/efficiency/blueprint/index.html

Residential Questions & Answers - Publication No. 400-00-005
Non-Residential Questions & Answers - Publication No. 400-00-006

Energy and Buildings Special "IBPSA" Issue

The April 2001 issue of the journal *Energy and Buildings* (Vol. 33, No. 4) featured selected technical papers from IBPSA's *Building Simulation 1999 Conference*, held in Kyoto.
You can visit the journal at http://www.elsevier.nl/locate/jnlnr/06009.

Energy and Building Performance Simulation: Current State and Future Issues by J. L. M. Hensen and N. Nakahara

Building Environment Simulation Before Desk Top Computers in the USA Through a Personal Memory by T. Kusuda

Domain Integration in Building Simulation by J. A. Clarke

Efficient Solution Strategies for Building Energy System Simulation by E. F. Sowell and P. Haves

Energyplus: Creating a New-Generation Building Energy Simulation Program by D. B. Crawley, L. K. Lawrie, F. C. Winkelmann, W. F. Buhl, Y. J. Huang, C. O. Pedersen, R. K. Strand, R. J. Liesen, D. E. Fisher, M. J. Witte and J. Glazer

Integrating Power Flow Modelling with Building Simulation by J. A. Clarke and N.J. Kelly

Systematic Analysis on Combined Heat and Water Transfer Through Porous Materials Based on Thermodynamic Energy by A. Ozaki, T. Watanabe, T. Hayashi and Y. Ryu

An Algorithm for Calculating Convection Coefficients for Internal Building Surfaces for the Case of Mixed Flow in Rooms by I. Beausoleil-Morrison

Modeling of Thermal Processes for Internal Melt Ice-On-Coil Tank Including Ice-Water Density Difference by Y. Zhu and Y. Zhang

Optimal Control Development for Chilled Water Plants Using a Quadratic Representation by B. C. Ahn and J. W. Mitchell

Fault-Tolerant Supervisory Control of VAV Air-Conditioning Systems by X.-F. Liu and A. Dexter

Online Fault Detection and Diagnosis in VAV Air Handling Unit by RARX Modeling by H. Yoshida, S. Kumar, Y. Morita

Fault Detection in HVAC Systems Using Model-Based Feed-Forward Control by T.I. Salsbury and R.C. Diamond

WINDOW 5, Beta 1

Total Window Thermal Performance

The WINDOW program calculates total window thermal performance indices (i.e., U-value, solar heat gain coefficient, shading coefficient, and visible transmittance). WINDOW 5 (Beta version 1) is available to download and test. The program contains these new features:

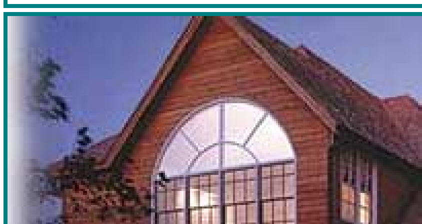
New in WINDOW 5, Beta 1:

- A state-of-the-art Microsoft Windows user interface
- Powerful features in all of the WINDOW libraries for modeling:
  - Windows
  - Glazing Systems
  - Glass
  - Gases
  - Frames
  - Dividers
  - Environmental Conditions
- Updated Algorithms consistent with ASHRAE SPC 142 and ISO15099
- A condensation-resistance index or indices (CI)
- A surface temperature map
- Connection to the Optics 5 optical data available at: http://windows.lbl.gov/materials/optics5/default.htm

You may download Beta 1 of WINDOW 5 from

http://windows.lbl.gov/software/window/beta/W50_beta1_getacopy.html

Your feedback is important to the developers; please email WindowHelp@lbl.gov with comments.



Efficient Windows Collaborative

To find out how to select an energy efficient window, please visit the Efficient Windows Collaborative (EWC) website at

http://www.efficientwindows.org

EWC provides unbiased information on the benefits of energy efficient windows, descriptions of how they work, and recommendations for their selection and use.

THERM 2.1a:

2-Dimensional Building Heat-Transfer Modeling

THERM, a module of LBNL's WINDOW program, models two-dimensional heat-transfer effects in building components such as windows, walls, foundations, roofs, doors, appliances and other products where thermal bridges are of concern. THERM's heat-transfer analysis allows you to evaluate a product's energy efficiency and local temperature patterns, which may relate directly to problems with condensation, moisture damage, and structural integrity. THERM's two-dimensional conduction heat-transfer analysis is based on the finite-element method, which can model the complicated geometries of building products. THERM's results are used with WINDOW's center-of-glass optical and thermal models to determine total window product U-factors and Solar Heat Gain Coefficients. These values can be used, in turn, with the RESFEN program, which calculates total annual energy requirements in typical residences throughout the United States.

THERM 2.1a is a bug-fix release based primarily on feedback from THERM 2.1 users. The code was converted to double precision and has had added a check to it that will catch any unforseen similar issues in the future. Going to double precision affects some answers (on the order of 0.1%) - this is less of an effect than starting at mesh parameter of 6 vs starting at mesh parameter of 8 (with all results getting to an EEN of less than 10%).

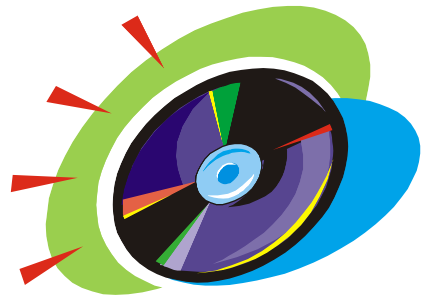
New in THERM 2.1a:

- Multiple Glazing Options feature made more robust, based on feedback from users
- Fixed bug with linked materials, including problems with triple glazed glazing systems and links to glazing cavities
- Fixed problems relating to files submitted by simulators—a flood fill problem, etc.
- Program now automatically fixes WINDOW 4.1 glazing systems that used to crash the program
- Fixed Radiation Enclosure bug
- Fixed sorting by date in the Calculation Manager Log, and also fixed a bug that caused the program to crash
- Improved program behavior when multiple frame cavities are selected
- Fixed problem with Boundary Conditions being created inside the WINDOW 4.1 glazing system, such as in Dividers

To download THERM 2.1a, please go to:
http://windows.lbl.gov/software/therm

DOE-2 Documentation on a CD !

What's on the CD?



- DOE-2 Reference Manual (Part 1)
- DOE-2 Reference Manual (Part 2)
- DOE-2 Supplement to the Reference Manual (2.1E)
- DOE-2 BDL Summary (2.1E)
- DOE-2 Engineers Manual (2.1A)

How much does it Cost?

- Cost of the CD is U.S.$100.

Order from ESTSC:

Ed Kidd
NCI Information Systems, Inc.
Energy Science and Technology Software Center
P.O. Box 1020
Oak Ridge, TN 37831

Phone: 865/576-1037
Fax: 865/576-6436
Email: estsc@adonis.osti.gov

What Isn't on the CD?	Where to Obtain Printed Documentation:
▪ Update Package #1: Changes and corrections to DOE-2.1E Basics, the Supplement and BDL Summary ▪ Update Package #2: Corrections to the BDL Summary and Supplement for DOE-2.1E. For Version 107 of DOE-2.1E, added Cooled Beam System and Polygon sections to the Supplement and BDL Summary. ▪ Update Package #3: Corrections to Appendix A of the Supplement.	Update Packages are .pdf files; they may be downloaded from our website at http://SimulationResearch.lbl.gov > DOE-2 > Documentation Update Packages are **not** cumulative and each contains different information. You must download all three packages to update the DOE-2 documentation completely.
▪ DOE-2 Basics (2.1E) ▪ DOE-2 Sample Run Book (2.1E)	These must be purchased separately from NTIS; details at http://SimulationResearch.lbl.gov > DOE-2 > Documentation]

The Building Energy Simulation User News is published bi-monthly and distributed electronically by the Simulation Research Group at Lawrence Berkeley National Laboratory, with cooperation from the Building Systems Laboratory at the University of Illinois. Direct comments or submissions to Kathy Ellington (KLEllington@lbl.gov). Direct BLAST-related inquiries to the Building Systems Laboratory (support@blast.bso.uiuc.edu). ***This work was supported by the Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Building Technology, State and Community Programs, Office of Building Systems of the U.S. Dept. of Energy, under Contract No. DE-AC03-76SF00098***

ENERGY-10, Version 1.3 with WeatherMaker

Version 1.3 of ENERGY-10 is now available. It includes the much-anticipated ***WeatherMaker*** function. *WeatherMaker* allows users to create their own weather files based on information available from nearly 4,000 weather stations throughout the U.S. Revisions to the program itself include some minor fixes, an improved and expanded Help section, and greater clarity in titling and identification of various sections. Contact the Sustainable Buildings Industries Council for more information, or to order your upgrade disc (the cost is $15, which covers production and shipping).

ENERGY-10, written in C^{++}, is a design tool for smaller residential or commercial buildings that are less than 10,000 ft^2 floor area, or buildings that can be treated as one- or two-zone increments. It performs whole-building energy analysis for 8760 hours/year, including dynamic thermal and daylighting calculations. ENERGY-10 was specifically designed to facilitate the evaluation of energy-efficient building features in the very early stages of the design process.

Input: Only four inputs required to generate two initial generic building descriptions. Virtually everything is defaulted but modifiable. As the design evolves, the user adjusts descriptions using fill-in menus (utility-rate schedules, construction details, materials).

Output: Summary table and 20 graphical outputs available, generally comparing current design with base case. Detailed tabular results also available.

Platform: PC-compatible, Windows 3.1/95/98, Pentium processor with 16 MB of RAM is recommended.

Douglas K. Schroeder
1331 H Street N.W., #1000
Washington, DC 20004

Tel: 202.628.7400 ext 210
Fax: 202.383.5043
www.sbicouncil.org

Sustainable Buildings Industry Council (SBIC)

❾

GenOpt® 1.1

New in GenOpt 1.1 are an additional algorithm for multi-dimensional optimization, algorithms for one-dimensional optimization, and an algorithm for parametric runs in a multi-dimensional space. The new version also allows processing of multiple function values and has an improved graphical user interface.

GenOpt is a multi-parameter optimization program, available free of charge from LBNL. It automatically finds the values of user-selected design parameters that minimize an *objective function*, such as annual energy use, calculated by an external simulation program like EnergyPlus, SPARK, DOE-2, BLAST, TRACE, TRNSYS, etc. GenOpt can be used with any simulation program that has text-based input and output. It also offers an interface for adding custom optimization algorithms to its library.

Genopt 1.1 (with user manual) may be downloaded from

http://SimulationResearch.lbl.gov > GenOpt

Building Design Advisor 3.0

Decision making through the integrated use of multiple simulation tools and databases

The **Building Design Advisor (BDA)** is a Windows program that addresses the needs of building decision-makers from the initial, schematic phases of building design through the detailed specification of building components and systems. The BDA is built around an object-oriented representation of the building and its context, which is mapped onto the corresponding representations of multiple tools and databases. It then acts as a ***data manager*** and ***process controller***, automatically preparing input to simulation tools and integrating their output in ways that support multi-criterion decision-making. Version 3.0 of the BDA is now available for Beta testing and includes links to three main simulation tools for daylighting, electric lighting and energy analyses:

- **DCM**, a simplified daylighting simulation tool,
- **ECM**, a simplified electric lighting simulation tool, and
- the **DOE-2.1E** building energy simulation program.

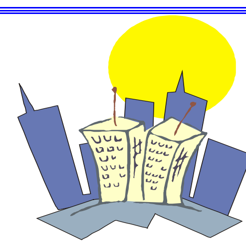
ECM, the **new electric lighting simulation tool** in BDA 3.0, is integrated through BDA with DOE-2. BDA's Schematic Graphic Editor allows placement of electric lighting luminaires and specification of reference points for daylight-based electric lighting controls. Moreover, BDA now has the capability of **running DOE-2 parametrically** to generate a plot that shows the relationship between effective aperture and energy requirements. BDA 3.0 provides the added functionality of working with either **English units or Metric units**.

Current research and development efforts are focused on the development of links to **Desktop Radiance**, a Windows 95/98/NT version of the **Radiance** lighting/daylighting simulation and rendering software.

The minimum and recommended system **requirements** to run the BDA software are as follows:

Minimum	**Recommended**
Pentium 75	Pentium 200 or better.
Windows 95, 98, NT 4.0.	Windows 95, 98, NT 4.0.
16 / 32MB RAM under Windows 95	24 / 64MB RAM under Windows NT 4.0.
30 MB of larger hard disk space.	60 MB or larger hard disk space.
640x480 or higher screen resolution.	1024x768 or higher screen resolution.

The BDA source code is available for licensing; if interested, please contact Dr. Papamichael at K_Papamichael@lbl.gov.
To learn more about the BDA software and to download a copy of the latest public version (BDA 2.0), please visit
http://gaia.lbl.gov/BDA
For Beta Testing of BDA 3.0, please contact Vineeta Pal at VPal@lbl.gov.



DOE-2 DOE-2 DOE-2

PC Version of DOE-2.1E from ESTSC

DOE-2.1E (version 110) for Windows is available from the Energy Science and Technology Software Center (ESTSC). Previously, ESTSC licensed only UNIX and VAX versions. This updated version of DOE-2 incorporates bug fixes and new features such as a Cooled Beam HVAC system and polygon input for walls, floors and ceilings. Like previous DOE-2.1E products from ESTSC, this version accepts textual BDL input but does not have a graphical user interface. Cost of DOE-2.1E-WIN (Version 110) is:

- $ 300 U.S. Government, non-profit Educational
- $ 575 U.S., Mexico, Canada
- $ 1075 Other Foreign

Ed Kidd
NCI Information Systems, Inc.
Energy Science and Technology Software Center
P.O. Box 1020
Oak Ridge, TN 37831

Phone: 865/576-1037
Fax: 865/576-6436
Email: estsc@adonis.osti.gov

DOE-2.1E Documentation on a CD

Most of the DOE-2.1E documentation (including the Engineers Manual, version 2.1A) has been scanned and put on one CD, available for US$100 from ESTSC. Call Ed Kidd to order.
DOE-2.1E Basics and the DOE-2.1E Sample Run Book are not included on the CD; they may be ordered from the National Technical Information Service; go to http://SimulationResearch. lbl.gov >DOE-2 > Documentation.

DOE-2.1E Documentation Updates Free of Charge

Three update documents, in .pdf format, are available on our website
http://SimulationResearch. lbl.gov > DOE-2 > Documentation.
The updates are ***not*** cumulative; each document contains different information so you need to download all the packages in order to completely update the existing documentation.

DOE-2 Help Desk

Due to health problems, our regular consultant, Bruce Birdsall, is temporarily unavailable.
In the meantime, please contact the Simulation Research Group with your questions:
Phone: (510) 486-5711, Fax: (510) 486-4089, Email: klellington@lbl.gov

DOE-2 Training

DOE-2 courses for beginning and advanced users:
phone Marlin Addison at (602) 968-2040, or send email to marlin.addison@doe2.com

DOE-2 DOE-2 DOE-2

Software Available from Lawrence Berkeley National Laboratory

Free Downloads	
BDA 3.0 (Building Design Advisor)	kmp.lbl.gov/BDA
COMIS (multi-zone air flow and contaminant transport model)	www-epb.lbl.gov/comis
EnergyPlus™ **1.0** (new-generation whole-building energy analysis program, based on BLAST and DOE-2)	SimulationResearch.lbl.gov > EnergyPlus
GenOpt®**1.1** (generic optimization program)	SimulationResearch.lbl.gov > GenOpt
RADIANCE (analysis and visualization of lighting in design)	radsite.lbl.gov/radiance/
Desktop Radiance (integrates the Radiance Synthetic Imaging System with AutoCAD Release 14)	radsite.lbl.gov/deskrad/
RESEM (Retrofit Energy Savings Estimation Model) (calculates long-term energy savings directly from actual utility data)	eetd.lbl.gov/btp/resem.htm
SUPERLITE (calculates illuminance distribution for room geometries)	eetd.lbl.gov/btp/superlite20.html
THERM 2.1a (model two-dimensional heat-transfer effects in building components where thermal bridges are of concern)	windows.lbl.gov/software/therm/therm.html
WINDOW 5 Beta (thermal analysis of window products)	windows.lbl.gov/software/window/window.html
Request by Fax from 510.486.4089	
RESFEN 3.1 (choose energy-efficient, cost-effective windows for a given residential application)	windows.lbl.gov/software/resfen/resfen.html
Web Based	
Home Energy Saver (quickly compute home energy use)	hes.lbl.gov
Purchase	
SPARK (Simulation Problem Analysis and Research Kernel) (build simulations of innovative building envelope and HVAC systems by connecting component models)	For Windows, SUN, Linux, go to SimulationResearch.lbl.gov > SPARK
ADELINE 2.0 (daylighting performance in complex spaces)	radsite.lbl.gov/adeline/

BLAST*news*

www.bso.uiuc.edu

Building Systems Laboratory (BSL)
30 Mechanical Engineering Building
University of Illinois
1206 West Green Street
Urbana, IL 61801
Telephone: (217) 333-3977
Fax: (217) 244-6534
support@blast.bso.uiuc.edu

The **Building Loads Analysis and System Thermodynamics (BLAST** program predicts energy consumption, energy system performance and cost for new or existing (pre-retrofit) buildings.

BLAST contains three major sub-programs:

- **Space Load Prediction** computes hourly space loads in a building based on weather data and user inputs detailing the building construction and operation.
- **Air Distribution System Simulation** uses the computed space loads, weather data, and user inputs.
- **Central Plant Simulation** computes monthly and annual fuel and electrical power consumption.

Heat Balance Loads Calculator (HBLC)
The BLAST graphical interface (HBLC) is a Windows-based interactive program for producing BLAST input files. You can download a demo version of HBLC (for MS Windows) from the BLAST web site (User manual included).

HBLC/BLAST Training Courses
Experience with the HBLC and the BLAST family of programs has shown that new users can benefit from a session of structured training with the software. The Building Systems Laboratory offers such training courses on an as needed basis typically at our offices in Urbana, Illinois.

WINLCCID 98
LCCID (Life Cycle Cost in Design) was developed to perform Life Cycle Cost Analyses (LCCA) for the Department of Defense and their contractors.

To order BLAST-related products, contact the Building Systems Laboratory at the address above.

Program Name	Order Number	Price
PC BLAST Includes: BLAST, HBLC, BTEXT, WIFE, CHILLER, Report Writer, Report Writer File Generator, Comfort Report program, Weather File Reporting Program, Control Profile Macros for Lotus or Symphony, and the Design Week Program. The package is on a single CD-ROM and includes soft copies of the BLAST Manual, 65 technical articles and theses related to BLAST, nearly 400 processed weather files with a browsing engine, and complete source code for BLAST, HBLC, etc. Requires an IBM PC 486/Pentium II or compatible running MS Windows 95/98/NT.	3B486E3-0898	$1500
PC BLAST Package Upgrade from level 295+	4B486E3-0898	$450
WINLCCID 98: executable version for 386/486/Pentium	3LCC3-0898	$295
WINLCCID 98: update from WINLCCID 97	4LCC3-0898	$195

The last four digits of the catalog number indicate the month and year the item was released or published. This will enable you to see if you have the most recent version. All software will be shipped on 3.5” high density floppy disks unless noted otherwise.

www.bso.uiuc.edu